Brookhaven National Laboratory

SNS

Ring and Transfer Lines Systems

A P R I L

MONTHLY REPORT

01 April – 30 April 2001

Performing Organization: Brookhaven Science Associates
Location: Brookhaven National Laboratory
Upton, New York 11973-5000

Contract Period: October 1998 – June 2006

Brookhaven National Laboratory
SNS MONTHLY PROGRESS REPORT
April 2001
Ring and Transfer Lines Systems

I. Senior Team Leader Assessment

1. TECHNICAL PROGRESS AND ACCOMPLISHMENTS

Ring Development – BNL

- Experiments were performed at Provino to test the crystal extraction of beam. Due to the difficulty of achieving necessary alignment between the beam and the crystal axis, not much was accomplished during this run. The consensus is that the crystal may not be useful for machine protection yet.

- The compensation coil to reduce the coupling impedance of the extraction kicker shows a factor of about 1.8 reduction. A proof of principle one tenth scale unit of the kicker was manufactured and tested to show close result. This gives great confidence of the full scale design.

Ring and Transfer Lines – BNL

- The first article ring dipole vacuum chamber has arrived from the vendor and is under test. The test includes dimensions and deformation under vacuum.

- The first article HEBT dipole vacuum chamber has been shipped by vendor enroute to BNL.

- The bids for the ring quadrupole 12Q40 have been opened. The evaluation for the offer is under way. All bidders give higher estimate than BNL budget.

- The first article half-cell support has been fabricated, final machined, inspected, and painted. The ring dipole magnet has been mounted as one of the tested procedure.

- Project office design review of the ring magnets, 26Q40, 30Q40, injection kicker, ring multipoles, was conducted with five engineers from ORNL.

- The pre-production unit of the PSI device has been under test. It performs up to about 97% of the design requirements. The recent improvement is on the reduction of the noise

from multipole sources. Once the test and improvements are complete, mass production of156 units will start.

- A meeting has been conducted with engineers from ORNL and BNL to start the planning of the early transfer of components from BNL to ORNL. Agreements have reached on the procedures and responsibility of each type of components. For example, BNL will be responsible for the component design, procurements, and first article test. The ORNL will be responsible for the documentation of the operation procedure, the maintenance procedures, the safety manual, and the installation. Such a plan has to be further developed for the determination of manpower and budget transfer from BNL to ORNL.

- The BNL has restructured the SNS/BNL project office to report to BNL Director directly, consolidated its staff, reduced EDIA and clarified the overhead as 12.75%.

- We have completed system integration documents, ICD of HEBT and Linac, ICD of Control and vacuum, DCD of the ring vacuum, RF, magnet, and collimation systems. They are all transmitted to DCC of the SNS Project office.

- BNL have reviewed the following talks to be given at the May DOE review. One STL overview, three accelerator physics, five ring system breakout.

2. ISSUES AND ACTIONS

- Due to the termination of R&D fund for the stripping foil study, no work was performed in this period. Whenever the new foil is produced, BNL will perform the lifetime test with beam at the SNS beam power level.

- Plan on early transfer has to be completed to ensure proper transition from BNL to ORNL and the performance of the ring system.

3. COST AND SCHEDULE STATUS

3.1 VARIANCE ANALYSIS AND PROJECT COST PERFORMANCE REPORTS

WBS 1.1.3 R&D

Variance Analysis (Cumulative to date) ($K)

BCWS	BCWP	ACWP	SV	%	CV	%
4723.3	4723.3	4842.2	0.00	0.0%	(118.9)	-2.5%

Variance Statement: Cum variances are within thresholds. No analysis required.
Current period cost variance for this LOE activity is driven by 1.1.3.3 where actual purchased material exceeds BCWS.

Project Impact: None.

Corrective Action: None.

WBS 1.5 Ring and Transfer Lines

BCWS	BCWP	ACWP	SV	%	CV	%
27171.1	26040.6	26772.6	(1130.4)	-4.2%	(732.0)	-2.8%

Variance Statement: Cum variances are within thresholds. No analysis required.
Current period variances are due to the incorporation of numerous PCRs this period.

Project Impact: None.

Corrective Action: None

3.2 MILESTONE STATUS

WBS 1.5 has no level 0 milestones. Milestone status is listed below.

Milestones	Level 1	Level 2	Level 3	Level 4	Level 5
Project	1	2	10	13	158
FY01	0	0	0	4	32
Due in Next 30 days	0	0	0	0	0
Total Due at present	0	0	3	11	83
Made	0	0	3	11	77
Missed	0	0	0	1	8
Ahead of Schedule	0	0	0	1	2

3.3 PROJECT CRITICAL PATH ANALYSIS

The critical path for the Ring is the Diagnostic Instrumentation, specifically the BPM and IPM systems. The next area that is critical within the ring is vacuum chambers and the ring dipole and quad magnet assemblies.

II. Detail R&D Subproject Status

WBS 1.1.3 – Ring System Development

The group mainly working of the DOE Review and will present 5 talks.

Fedotov and Nuria, went to Protvino Russia to acquire experimental data for collimation studies. First (and last) tests with a bend crystal as primary collimator. First analysis of the past autumn data.

Revision of the expected losses in the HEBT transverse collimators. Dependency with the Linac emittance.

Update the parameter list for the project.

Publish the note SNS-AP.TN7: "Expected beam losses along the SNS accelerator facility during normal operation".

Simulations of the RF system including dynamic tuning and low level loops continued.

Variance Analysis (Cumulative to date) ($K)

BCWS	BCWP	ACWP	SV	%	CV	%
4723.3	4723.3	4842.2	0.00	0.0%	(118.9)	-2.5%

Variance Statement: Cum variances are within thresholds. No analysis required.
Current period cost variance for this LOE activity is driven by 1.1.3.3 where actual purchased material exceeds BCWS.

Project Impact: None.

Corrective Action: None.

III. Detail Line Item Subproject Status

WBS 1.5.1 – HEBT Systems

ORNL requested a change again on how and where the HEBT dipole magnet will be measured. The new agreement is that the 1st article dipole will be shipped directly to ORNL for measurement. ORNL will provide the design and fabricate all of the measuring equipment. BNL will stop work on this effort.

Tesla has revised their HEBT dipole magnet production schedule slightly. The 1st article magnet should be in the USA by the middle of August. The inability to find a European Vendor who could provide the long pieces of steel necessary was sighted as the reason for the delay. In addition, their schedule allows three weeks for shipping for the UK. Metals USA is providing the steel of the HEBT dipole magnet. During W. Birkholz visit to Metals USA he saw the steel being prepared for Tesla. The steel should be shipped before the end of May. They estimate three weeks for shipping time to the UK. Tesla provided coil fabrication fixture drawings for review (not approval). Tesla should be able to start coil fabrication in June.

The purchase order for production of the 12Q45 quadrupoles and 16CD20 corrector magnets was awarded to Danfysik. This is a phased procurement with _ the magnets funded this fiscal year. As with the HEBT dipole the revised agreement is that the first article magnets will be shipped directly to ORNL for inspection and measurement. The present estimated delivery date is 10/30/01.

The detail design of the 21cm quadrupole chambers in the HEBT arc is complete. The vendor continues inspections of the first standard dipole chamber. The layout of vacuum chambers has been matched to the official lattice. AP is reviewing drawings for the dipole chambers with extraction ports. RFQ for 4.5” and 8” beam tubes has been generated and forwarded to potential vendors. Drawings for special CFX flanges and Inconel 625 bellows were sent to vendors for quotes. Work on turbomolecular pump specification has begun.

In order to fit the collimators, flanges, and bellows into the space between the quadruple magnets in the HEBT line it will be necessary to reduce the length of the collimators by ten inches. Replacing the particle bed with stainless steel plates will accommodate this reduction. Thus effectively increasing the density of stainless steel in the path of the captured protons. In addition, the second collimator will have to be modified to accommodate the second charge exchange foil drive mechanism.

Variance Analysis (Cumulative to date) ($K)

BCWS	BCWP	ACWP	SV	%	CV	%
2380.5	2325.1	2034.7	(55.5)	-2.3%	290.4	12.5%

Variance Statement: Cum cost variance exceed thresholds whereas BCWP exceeds ACWP. WBS 1.5.1.1 and 1.5.1.5 are primary drivers for the variance. Approved PCR RIO1016 will adjust variances below thresholds when implemented.

Project Impact: None.

Corrective Action: None.

WBS 1.5.2 – Injection Systems

The injection foil mechanism drawings have been reviewed and approved. Parts for the foil mechanism are being ordered. Both septum magnet drawings are still in the final approval stage. Work is now underway laying out and designing the beam tubes for the injection region straight section. This includes the transition from the HEBT line and the transition into the beam dump line. The beam tube for the foil mechanism is being redesigned to incorporate a revised stripped electron collector plate design.

The checking of long injection kicker drawings was completed. A final design review for the design was held in April. Final approval of the design drawings awaits completion of components for the extraction kicker PFN tank.

Variance Analysis (Cumulative to date) ($K)

BCWS	BCWP	ACWP	SV	%	CV	%
1677.9	1742.4	1942.2	64.6	3.8%	(199.8)	-11.47%

Variance Statement: Cum cost variance is driven by WBS 1.5.2.2 Injection Kicker PS whereas actual costs were greater than planned due to the redesign of the PS (programmable).

Project Impact: None.

Corrective Action: None.

WBS 1.5.3 – Magnet Systems

QA testing of the magnet coils continues. More than 60 of the 76 coils ordered have been tested. BNL still awaits delivery of the final batch of coils and BNL will be returning 4 coils for repair. All four coils failed because of leaks at the braze joint between the stainless steel hose fitting and the copper bus material. The core steel for The Allied Engineering (production order for the 1.3 GeV ring dipole magnet cores) is being machined to the rough overall dimensions and then heat-treated. W. Birkholz visited all three shops involved in this operation, which are in the Canton, Ohio area. Photographs have been forwarded to the project office. The material will be at Allied in May for final machining.

Tesla Engineering Ltd provided a production schedule for the 21Q40 that meets the requirements of the purchase order and the BNL magnet assembly schedule. The orders for both the copper

and core steel have been placed according to schedule. Final measurements of the prototype magnet have been completed.

The Danfysik confirmed their schedule for production of the 27CDM30 corrector. The 1st article unit should be shipped to BNL by July 1, 2001. A change order was approved for polymide/mede-coated wire with high temperature and radiation resistance.

The 1.3 GeV magnet 1st article has been placed on the first base for one more set of magnetic measurements to determine the effect (if any) the base has on the field in the aperture. The second and third cell bases were delivered by the vendor heat treated (stress relieved) and painted. These came in from the vendor with the correct color.

Drawings for the 21CS30 and 21CO30 sextupole and octupole corrector magnets are being checked. They will go out for bid next month.

A RFQ for the first article 26Q40 magnet was sent out for bids. The design for the 30Q44 is being modified to provide mounting points for the BPM.

Variance Analysis (Cumulative to date) ($K)

BCWS	BCWP	ACWP	SV	%	CV	%
3938.2	3710.4	4721.8	(227.8)	-5.8%	(1011.4)	-27.3%

Variance Statement: Magnet System has a cum CV of -$1,011.4K (27.3%) and is driven by WBS 1.5.3.1 High Field Magnets whereas actual material purchases are greater than performed.

Project Impact: None.

Corrective Action: None.

WBS 1.5.4 – Power Supply Systems

Work continues on the preparation the medium range power supplies RFP. A package is expected to be released to procurement by the end of May. Another ongoing effort is the extensive testing of the PSI.

With the approval of the mineral insulated corrector PCR, a change order to the Low Field Corrector contract was submitted to purchasing. These bipolar units, which are rated 120 Amps, will be manufactured along with the other production units.

First article testing of the Injection Bump Power supplies has been re-scheduled for June 27-29. This will be the first power supply that will be tested with a PSI at the vendor's facility.

Review effort this month included a Project Office review at BNL of equipment hand-off. This also provided an opportunity for separate power supply discussions in the areas of incoming

testing, installation, and commissioning. Also, preparations were made for the semi-annual DOE review at ORNL in May.

Variance Analysis (Cumulative to date) ($K)

BCWS	BCWP	ACWP	SV	%	CV	%
863.3	601.9	451.4	(261.4)	-30.3%	150.5	25.0%

Variance Statement: Power Supply Systems with cum period SV -$261.4K (-30.3%) and a cum period CV $150.5K (25.%) are driven by WBS 1.5.4.1 and 1.5.4.2 respectively. Current period variances reflect same WBS impact as cum period. Approved PCR RIO1016 and RIO1013 will adjust variances below thresholds when implemented.

Project Impact: None.

Corrective Action: None.

WBS 1.5.5 – Ring Vacuum System

The vendor has shipped the first dipole chamber due to arrive at BNL in early May. The welding fixture for the halfcell chambers is being detailed. The 1st article ring all-metal gate valve has arrived and is being inspected. The remaining valves will be shipped to ORNL.

A vacuum gauge controller from another manufacturer was tested for its response time after a real pressure rise. Suitable ion pump cables and sources for them have been identified. Work on vacuum control software is under way.

The vacuum team leader attended the PO Handoff meeting and presented the vacuum system handoff. The ICD between vacuum and control and the DCD for HEBT, Ring and RTBT vacuum systems are finalized and available on the WEB. The specification and statement-of-work for the large sputter ion pumps are completed. The RFQ for the ion pumps has been submitted.

Variance Analysis (Cumulative to date) ($K)

BCWS	BCWP	ACWP	SV	%	CV	%
1812.1	1739.1	1680.8	(72.9)	-4.0%	58.3	3.4%

Variance Statement: Variances are within thresholds. No analysis required.

Project Impact: None.

Corrective Action: None.

WBS 1.5.6 – RF System

Assembly of the power amplifier and beam simulator continues. The cavity shroud is in the shops. The capacitor bank for the anode supply is being assembled.

Variance Analysis (Cumulative to date) ($K)

BCWS	BCWP	ACWP	SV	%	CV	%
3433.2	3234.6	3314.0	(198.6)	-5.8%	(79.4)	-2.5%

Variance Statement: Variances are within thresholds. No analysis required.

Project Impact: None.

Corrective Action: None.

WBS 1.5.7 – Ring Diagnostics

- An initial "Hand-off" meeting was held at BNL.

1.5.7.1 – BPM

- Design Drawings for the 26cm Ring BPM have been signed-off.
- The ECN for the 21cm Ring Drawing updates has been signed-off.
- Received all machined parts for the production 21cm HEBT BPM first articles.
- Preparing ECNs for the 21cm and 12cm HEBT BPMs.
- Add'l material has been ordered for the increased number of HEBT BPMs.
- Work continues on the solution to mounting the 30cm Ring BPM onto the pole tips of the redesigned narrow 30cm quad.
- An investigation into beam based alignment for HEBT and RTBT revealed trim coils are available in quads with the exception of the 12cm quads. The possibility of adding windings to the 12cm quads is under investigation.

1.5.7.2 – IPM

- Drawings for the electron detector are in the shop.
- Initial measurements of the electron detector, mounted in the AGS Booster, indicate the electron detector is being flooded by other interfering signals, perhaps image currents. Shielding is being considered to resolve this.

1.5.7.3 – BLM

- Discussions continue on BLM interface with the MPS and operational requirements.
- A meeting is scheduled for May 3rd at LANL to discuss BLM issues

- BLMs have been tested with the fast proton beam transported to the G-2 target to investigate biasing, sensitivity and saturation effects.
- An investigation of X-Ray effects on the BLMs is underway.

1.5.7.4 – BCM

- The AFE electronics is now in layout. Initial component placement is under review.
- A set of real-time timing signal requirements is being prepared to assure proper Industrial Pack design.
- Work continues on the gain control digital circuitry and interface with the LANL motherboard.
- A method of using differential current measurements of upstream and downstream current transformer signals is under investigation as a fast MPS interrupt to protect the low energy MEBT and Linac area where the BLMs may not work well.
- A change to the current resolution requirements to 0.5% from 0.1% reduces the number of required gain changes for the Ring BCM electronics. Design changes are in progress.

1.5.7.5 – Tune

- Work continues on the prototype Tune Meter System.

1.5.7.6a – Carbon Wire Scanner

- A new ME is on-board and is familiarizing himself with the system, reviewing calculations, concepts, and design.
- Drawings for the MEBT wire scanner are in the shop.
- Work is underway in the shops for the MEBT wire scanner fork and connection parts.
- The attachment technique for the carbon wires is under investigation in hopes of finding a common design, LANL/BNL.
- A linear actuator has been received.

1.5.7.6b – Laser Wire Scanner

- The first laser has been returned for installation of a pointing diode to ease alignment.
- A second laser (50mJ) unit for MEBT has been received.
- The MEBT laser platform profile has been modified to remove a small interference.
- Laser and optics radiation hardness is under investigation.
- Motion control of the cross-slide actuators is under investigation.
- A presentation has been made to BNL-AP and again to the SNS team during a videoconference. This has stimulated considerable interest in using this technique as a baseline profile diagnostic for SNS, and particularly in SRF.
- An engineer has been assigned to look into costs associated with the laser wire profile monitor.

Variance Analysis (Cumulative to date) ($K)

BCWS	BCWP	ACWP	SV	%	CV	%
3089.8	2827.3	3014.8	(262.5)	-8.5%	(187.6)	-6.6%

Variance Statement: Variances are within thresholds. No analysis required.

Project Impact: None.

Corrective Action: None.

WBS 1.5.8 – Collimation and Shielding

1.5.8.1 – Ring Collimation

The drawings of a ring collimator tube have been completed and have been included in a package, which was sent out for vendor bid. The package includes the last collimator in the RTBT line.

1.5.8.2 – Moveable Shielding

An accelerator safety systems review committee has reviewed the prototype moveable shield and has made several recommendations. All the recommendations will be acted upon, and the revised design will form the basis of all subsequent devises.

Variance Analysis (Cumulative to date) ($K)

BCWS	BCWP	ACWP	SV	%	CV	%
825.0	773.6	835.7	(51.4)	-6.2%	(62.2)	-8.0%

Variance Statement: Variances are within thresholds. No analysis required.

Project Impact: None.

Corrective Action: None.

WBS 1.5.9 – Extraction System

The detail fabrication drawings for the prototype extraction kicker have been approved and all of the parts are on order. The design of the oil filled version of PFN continues.

Effort continues on revising the layout of the extraction region to take into account the roll of the Lambertson magnet continues. Design is being completed for the "Y-shaped" vacuum chamber used on the 17D240 bending dipoles in the RTBT (as well as the future transfer line to proposed second target).

Variance Analysis (Cumulative to date) ($K)

BCWS	BCWP	ACWP	SV	%	CV	%
686.9	567.7	548.6	(119.2)	-17.4%	19.1	3.4%

Variance Statement: Extraction System with a cum SV of -$119.2K (-17.4%) is driven by WBS 1.5.9.2 Extraction Kicker Power Supply -$103.9K. Extraction Kicker PS is affected by the redesign of PCR RIO1021.

Project Impact: None

Corrective Action: None.

WBS 1.5.10 – RTBT System

Design of the fixtures for winding the solid radiation resistant bus (for the 41CD30 correctors) continues. A sample water-cooled radiation resistant mineral bus material was received from the vendor. Enough material for one quadrupole magnet core is being ordered.

The first stage of the Linac and Ring beam dump vacuum window analysis was completed and reviewed by the project office. The results show that the windows can be located adjacent to the ring tunnel. This greatly simplifies the in ground drift tube design and the design of the dumps themselves providing significant project savings. A revised ICD is being written.

The drawings for the second collimator of the RTBT line have been completed and are being distributed to potential vendors.

Variance Analysis (Cumulative to date) ($K)

BCWS	BCWP	ACWP	SV	%	CV	%
1104.3	1158.1	987.3	53.8	4.9%	170.8	14.8%

Variance Statement: RTBT System has a cum CV of $170.8K (14.8%) and is driven by 1.5.10.5 RTBT Collimator and Shielding whereas BCWP is greater than ACWP. Approved PCR RIO1004 will correct variances below thresholds when implemented.

Project Impact: None.

Corrective Action: None.

WBS 1.5.12 – Technical Support

Space-charge experiments in the AGS booster and calibration of the new flag.

Measurements of the impedances for different kickers continued.

Three technical notes written supporting the PCRs on low field corrector PS, additional quadrupole PS and chromaticity sextupoles.

End to end simulation are in progress for new working point. The study of resonance crossing with space charge which is directly related to the choice of working point.

The UAL 1.0 Environment was installed on the alice.sns.ornl.gov, the ORNL alpha-cluster.

The UAL 1.0 Environment was reinstalled on the BNL SNS Linux cluster after upgrading of the Linux to Red Hat 7.0 that was carried out.

The draft of the C++ code and Perl API documentation was prepared for the PAC module of UAL 1.0 Environment.

For last month (whatever you did not figure yourself).

Preparation of the web page for the BNL/SNS AP group.

Variance Analysis (Cumulative to date) ($K)

BCWS	BCWP	ACWP	SV	%	CV	%
7353.7	7353.7	7240.5	0.0	0.0%	113.1	1.5%

Variance Statement: Variances are within thresholds. No analysis required.

Project Impact: None.

Corrective Action: None.

WBS 1.9.1 – R&D

WBS 1.9.2.2 – Global Timing

I reviewed with Dave Gurd and Bill Devan the cost estimate for the timing system PCR. A revised estimate was discussed with Bill on Friday 4/27. The one unsettled issue is the cost of an eventlink monitor. In the coming months Brookhaven will modify a RHIC monitor and test it at the SNS clock frequency. The eventlink monitor circuitry was originally designed for 10 MHZ and was “tweaked” to operate at the RHIC beam sync frequency of 14.15 MHz. We are not sure what issues, if any, will develop when it is configured to operate at the SNS event link frequency of 16.92 MHz. The estimate in the PCR assumes no significant changes will be necessary.

Event Link

A prototype eventlink master remains set up in the SNS controls lab for driver development.

V101 – Eventlink input modules:

This task is complete. 12 modules have been built

V123S – Beam synchronous encoder:

Assembly of additional prototype V123s modules is complete, with the exception of the rework required for SNS. Rework of the five modules should be complete this week. After the design review, artwork changes will be made to incorporate the changes and two production SNS encoders will be built.

V124s – Beam synchronous decoder:

The prototype PCB has been assembled at Brookhaven. Preliminary testing is well along and all major functions have been tested and are working. J. Tang will develop test software so that testing of the interrupt function can be completed. Some minor PCB changes are required. Finalization of the PCB artwork will wait until the design review. The front panel layout has been designed and two front panels are being fabricated. A second V124s has been built, but not tested. The V124s module description has been written and given to J. Tang for software driver development. This task is on schedule.

RTDL

Using RHIC spares, we set up an RTDL system at BNL in building 830 for software development. The output of the RTDL system in connected to a RHIC V108 system utility module so that the RTDL data can be read.

The PCBs for eight V105s and 12 two channel V106s have been received. In addition, backplanes for the RTDL system have been received. Parts orders for the V105 and V106s have gone out. All parts for the V105s have been received and two modules are now built, but not tested. The CRC modification to the RTDL transmission has been made and simulated. Both V105s will be configured as SNS encoders with the CRC for testing. This test will take place during the first week of May. Most parts for the V106s have arrived. Construction of the V105s and V106s should be complete by mid May.

Brookhaven is in the process of redesigning the V106 to increase the channel capacity to eight. This module will be called the V206. This redesign will be completed by September. The two channel and eight channel modules can coexist in the same system, so existing V106 modules built for SNS can be used in the production system if desired. The V206 will give the SNS RTDL system 128 frame capacity without additional chassis or RTDL bus extenders, as is now the case at BNL.

Eventlink Fanouts

We can use RHIC spares for prototype systems. The production fanouts will be 1X16.

WBS 1.9.2.2 –Timing Software

Event Timing System:
Work on EPICS drivers for the SNS Timing System VME modules continues. The modules are V123s and V124s. We are using a modified RHIC V124 module for testing while waiting for the V124s to be delivered. The V124S and V124 are similar so very little change to the software will be required when the V124S boards are delivered.

RTDL System:

A SNS RTDL test stand has been setup. It includes

V105 and V106 - We are using the RHIC V106 for testing while waiting for the SNS V206)

V108 Utility Board – We are using the RHIC V108 for testing while waiting for SNS Utility module.

EPICS driver development work will start this month. The RTDL interface to the RHIC and SNS versions of the board are nearly identical so software development can proceed. Prototype of the Epics drivers is expected to be complete about the end of May.

An abstract on "EPICS Software Development for SNS VME-based Timing and RTDL systems" has been submitted to ICALEPCS 2001 conference.

WBS 1.9.5.1 -Ring Controls Integration

A new Linux computer arrived this month and is being installed as part of the Linux cluster. While physically part of the cluster it will be used for Epics development. The purpose of the computer is to have a system available that Ernest Williams can use to install Epics software. Next month the system will be installed and testing of software can start. Making it part of the cluster means that

WBS 1.9.5.2 - Power Supply Controls

PSI:
The PSI hardware testing is nearing completion. Tests were done with different sets of input resistors to see which gave the optimum analog readback performance. The analog input tests now give very good results. Figures below show the ADC accuracy and stability.

See figures 1-4 below. The horizontal axis is input voltage. The vertical scale is averaged output (10 samples) minus input voltage. This gives the reading error over the full range of input (-10volts to +10volts). The resolution, 1 bit, is 300 microvolts. The graphs show the error is less that 1 bit over the input range. Graphs are shown for each of the four input channels**.**

See figures 5-6 below. This is the code distribution for a fixed input voltage using 1000 readings.

PSC:
There are some issues that need to be resolved with the PSC. At the conclusion of the PSI tests we will be able to concentrate on resolving PSC issues. We are modifying the link tester so that

it can generate bad checksums on command. This is needed to make sure that both the PSI and PSC recognize packets with bad checksums.

Epics Driver:
We continue to write the Epics drivers but most of the effort was on testing the PSI boards.
A prototype version of EPICS support for the PSC was written and it is now being integrated with the EPICS database. This is a preliminary version of the software since we do not have the final version of the PSC.

Ethernet Digitizer & Function Generator:
We still do not have the software for the Yokogawa instruments. The local salesman contacted the factory and said he expects we will be able to get the software if we sign a non-disclosure agreement. The software documentation will be in Japanese and so will have to be translated. This is not expected to be a problem.

Injection Power Supply:
We have been notified that some factory acceptance tests will be done on the injection power supply in June and some controls software will be needed. As a minimum, we will need a PSC/PSI with software to read status, issue on/off commands and read static power supply voltages. A function generator will be needed to test ramping and a digitizer will be needed to measure the scope performance. Full Epics controls software need not be available for the test. We will provide a PSI/PSC interface with Epics or Labview software and a function generator with off-line waveform generation software. Digitization will be done using a scope. Although only accurate to 8-bits, it will be adequate for the initial tests.

Power Supply Testing at the Factory:
The power supply group needs a test setup using PSC/PSI to control power supplies ready in September. A system is needed for factory test of the prototype power supplies at the vendor facility.

WBS 1.9.5.3 – Diagnostics

Software and hardware will be needed to test collimators in September. The software and hardware requirements will be defined next month. The prime requirement is for motion control software. We only need software to test the hardware. EPICS VME software will not be required for over a year. Testing will help define the interface requirements. For these initial tests we plan to use a PC and Labview.

WBS 1.9.5.4 - Vacuum

Work is continuing on the software design of the Vacuum control system. We must wait until the controller interfaces have been defined and some test controllers have been purchased. We continue to improve on the Vacuum lab. A PAC2001 paper on SNS Ring Vacuum Control System will be delivered at the end of May or beginning of June.

PLC ladder logic programming on valve interlocking and its global control system interfaces, operator interface screens are planned to be worked on during the rest of FY01.

An abstract on “SNS vacuum instrumentation and control systems” has been submitted to ICALEPCS 2001. The focus of this paper is “collaboration” effort.

WBS 1.9.5.5 - Application Software

SNS Ring Application Toolkit.
The prototype of the UAL Application Manager has been completed and installed on the BNL and ORNL computers. The Application Manager is the first module of the UAL 2.0 application toolkit. It aims to provide the Windows Explorer-like navigation interface to diverse UAL 2.0 toolkit applications.

The UAL Accelerator Model has been integrated with the UAL Application Toolkit. The Accelerator Model is a collection of Java containers with accelerator lattices and element attributes that can be shared by diverse commissioning and engineering applications. The development of Accelerator Model /XML and Accelerator Mode l /Database interfaces are in progress.

SNS Ring Simulation Environment:
The UAL 1.0 Environment was reinstalled on the Linux cluster after upgrading of Linux to Red Hat 7.0 was completed. Now the UAL 1.0 Environment uses the standard Red Hat 7.0 installation package: gcc compiler (version 2.96) and Perl (5.6.0).

The draft of the C++ code and Perl API documentation was prepared for the PAC (Platform for Accelerator Codes) module of UAL 1.0 Environment.

The implementation of the Transverse Impedance Module in the UAL 1.0 was started.

WBS 1.9.5.6 – RF

There was no work done on the RF system. The ICD for the Low Level RF is expected in May.

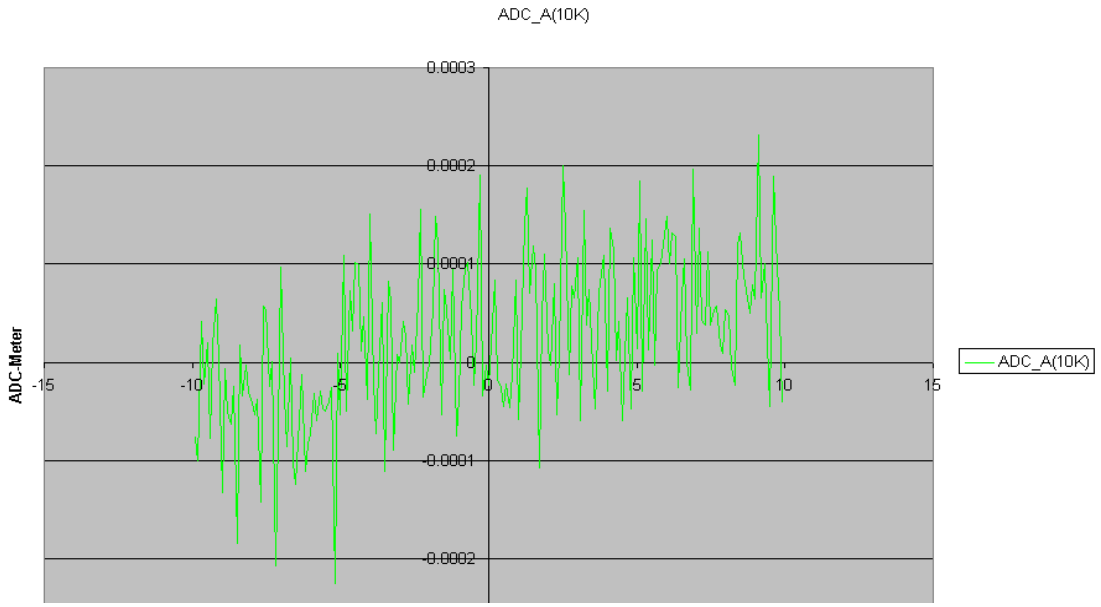


Figure 1 - Channel A, Reading Error vs Input Voltage

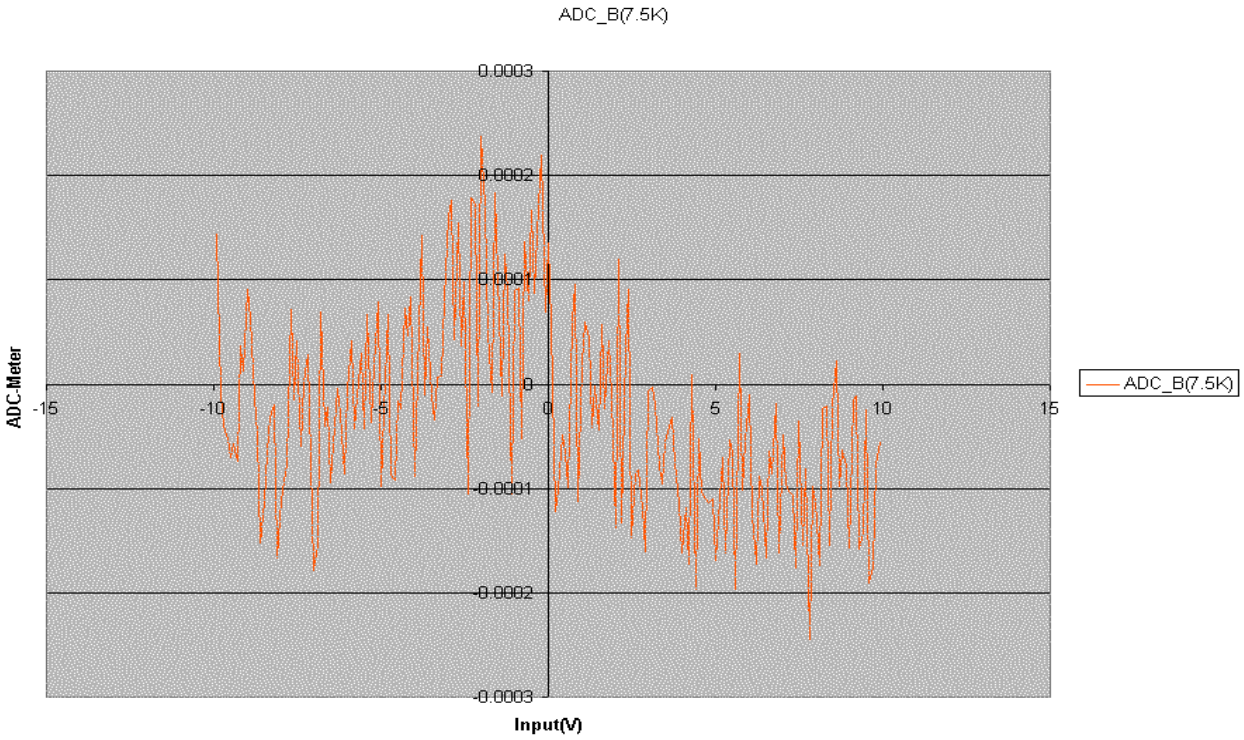


Figure 2 - Channel B, Reading Error vs Input Voltage

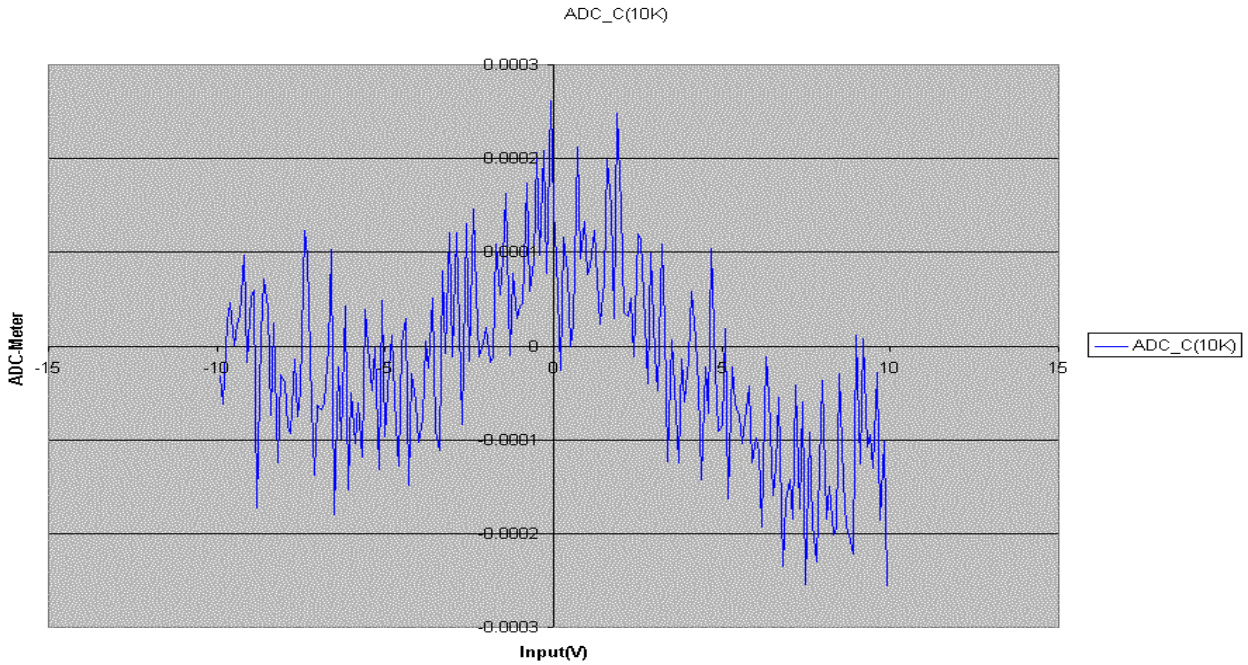


Figure 3 - Channel C, Reading Error vs Input Voltage

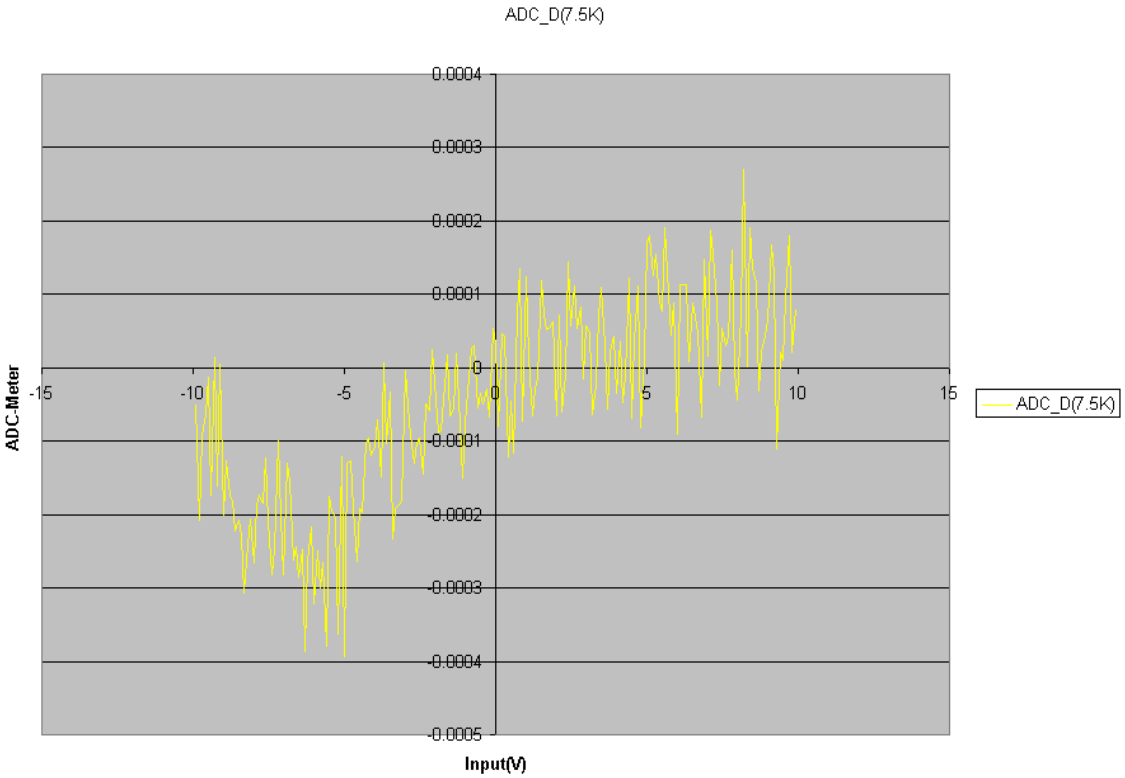


Figure 4. Channel D, Reading Error vs Input Voltage

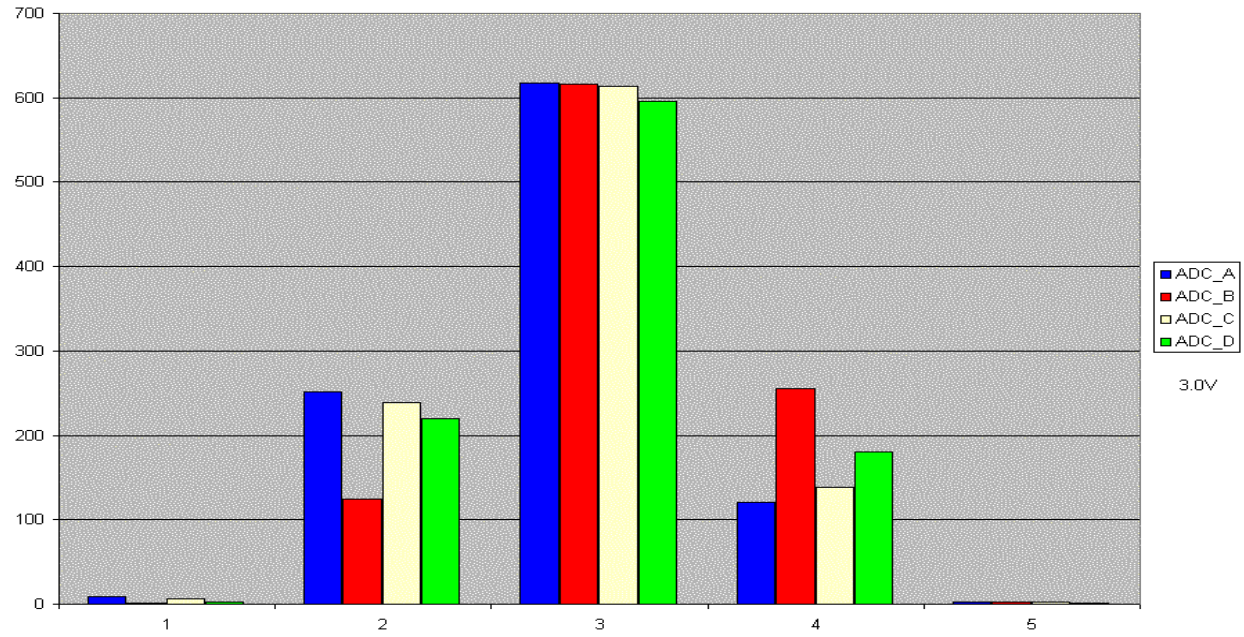


Figure 5. Code Distribution With 3.0 Volts Input (1000 readings on each channel)

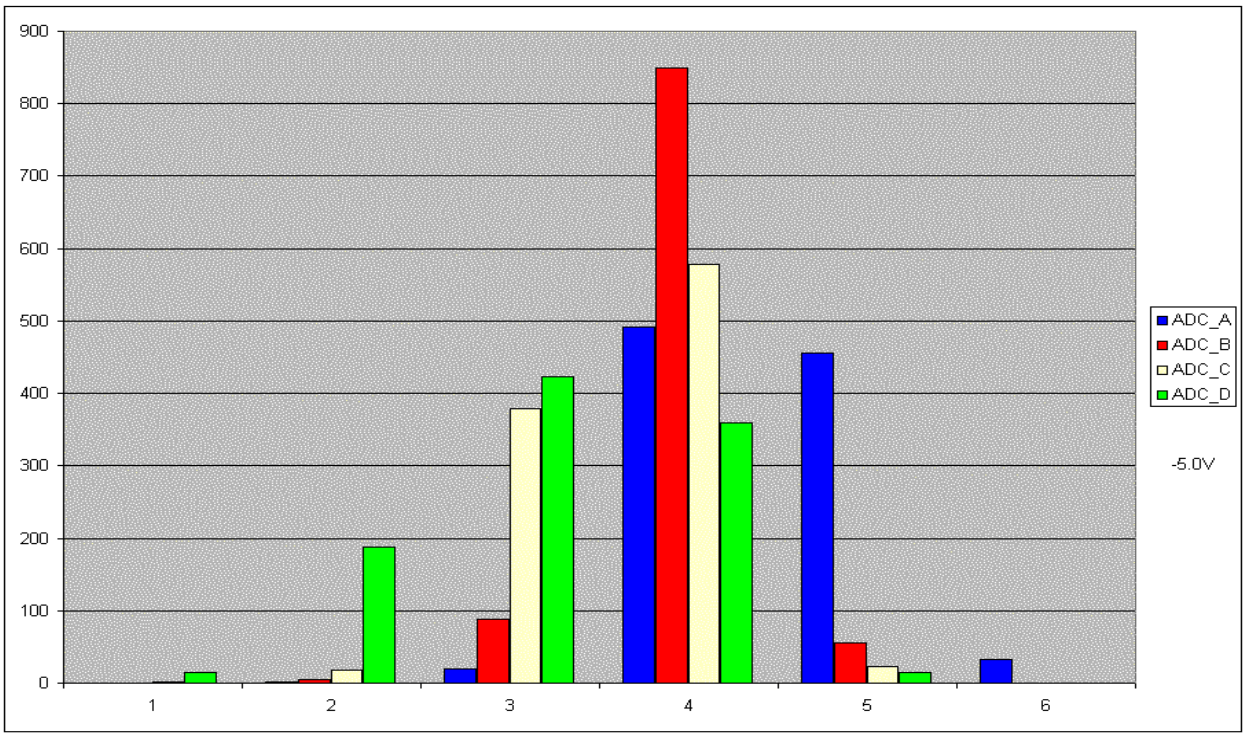
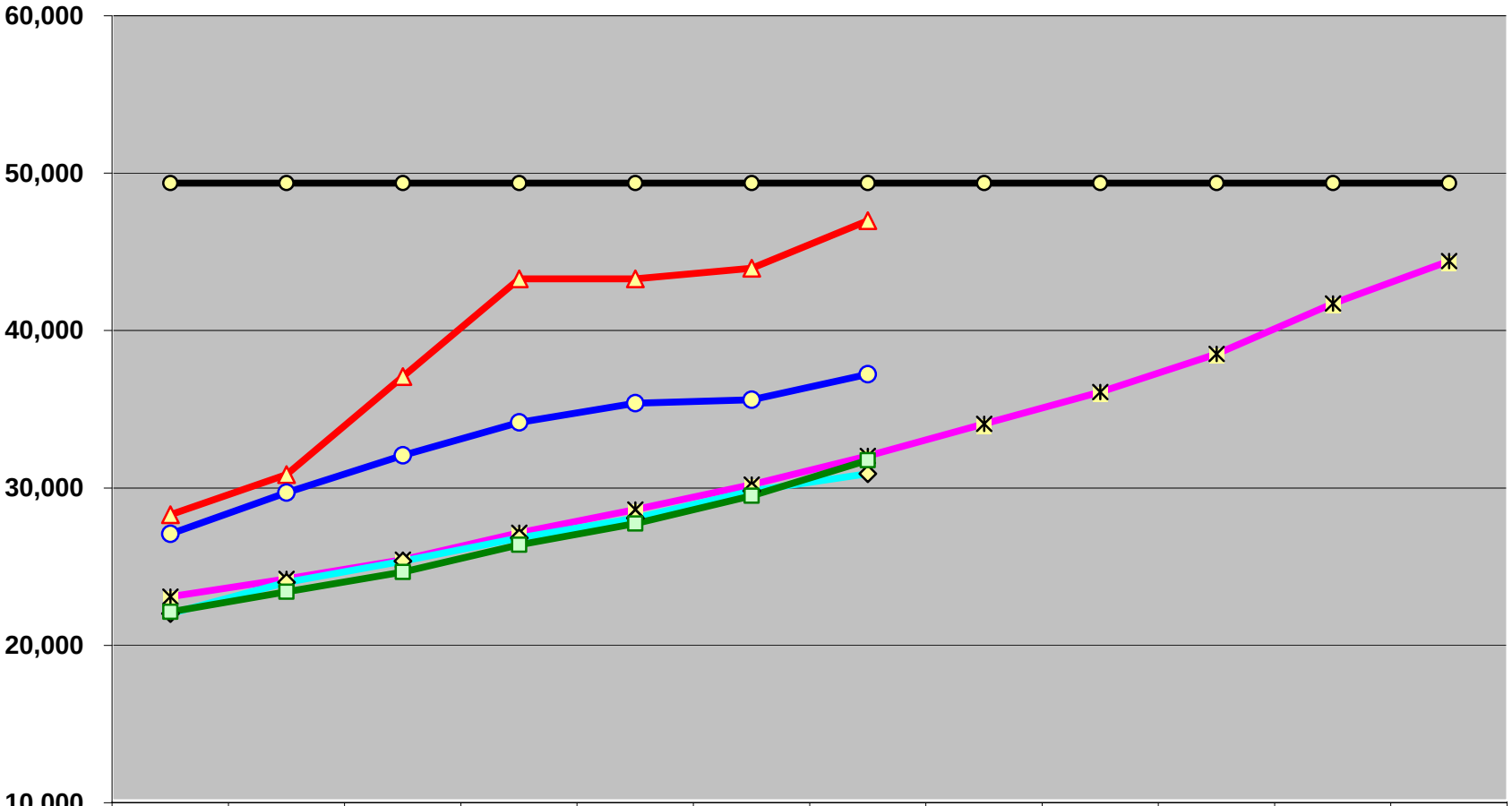


Figure 6. Code Distribution With –5 Volts Input (1000 readings on each channel)

IV. Earned Value Reports and Charts

1.5 & 1.1.3 Performance Measurement Chart



	Oct-00	Nov	Dec	Jan-01	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Cum Planned BA	49,225	49,225	49,225	49,225	49,225	49,225	49,225	49,225	49,225	49,225	49,225	49,225
Cum Authorized BA	28,155	30,710	36,924	43,138	43,138	43,813	46,840					
Cum Actual BA	26,928	29,553	31,930	34,012	35,242	35,448	37,075					
Cum BCWS	22,943	24,067	25,297	27,014	28,480	30,058	31,894	33,931	35,946	38,373	41,578	44,275
Cum BCWP	21,864	23,850	25,201	26,688	27,938	29,666	30,764					
Cum ACWP	21,979	23,263	24,516	26,238	27,582	29,359	31,615					

Months

U.S. DEPARTMENT OF ENERGY
COST PERFORMANCE REPORT - WORK BREAKDOWN STRUCTURE (FORMAT 1)

PROJECT TITLE: SPALLATION NEUTRON SOURCE	**REPORTING PERIOD:** 1-Apr-01 thru 30-Apr-01	**PROJECT NUMBER:** 99-E-334
		START DATE: October 1998
PARTICIPANT NAME AND ADDRESS: Brookhaven National Laboratory, Brookhaven, NY	**BCWS PLAN DATE:** October 1999	**COMPLETION DATE:** November 2006

WORK BREAKDOWN STRUCTURE	CURRENT PERIOD					CUMULATIVE TO DATE					AT COMPLETION		
	Budgeted Cost		Actual Cost	Variance		Budgeted Cost		Actual Cost	Variance				
	Work Scheduled	Work Performed	of Work Performed	Schedule	Cost	Work Scheduled	Work Performed	of Work Performed	Schedule	Cost	Budgeted	Revised Estimate	Variance
1.1.3 Rings System Development	77.5	77.5	247.4	0.0	(169.9)	4,723.3	4,723.3	4,842.2	0.0	(118.9)	5,111	5,111	
1.5 Ring & Transfer Line System	1,758.8	1,020.0	2,008.9	(738.8)	(988.9)	27,171.1	26,041	26,772.6	(1,130.4)	(732.0)	122,520	122,520	
1.5.1 HEBT (High Energy Beam Transport) Systems	174.3	112.7	100.0	(61.6)	12.7	2,380.5	2,325	2,034.7	(55.5)	290.4	10,641	10,641	
1.5.2 Injection Systems	58.1	65.0	97.2	6.8	(32.2)	1,677.9	1,742	1,942.2	64.6	(199.8)	9,210	9,210	
1.5.3 Magnet Systems	256.4	47.01	759.9	(209.4)	(712.8)	3,938.2	3,710	4,721.8	(227.8)	(1,011.4)	16,165	16,165	
1.5.4 Power Supply System	173.5	38.6	23.8	(134.8)	14.9	863.3	602	451.4	(261.4)	150.5	5,465	5,465	
1.5.5 Vacuum System	63.7	48.5	82.6	(15.3)	(34.2)	1,812.1	1,739	1,680.8	(72.9)	58.3	11,498	11,498	
1.5.6 RF System	138.6	43.3	109.1	(95.3)	(65.8)	3,433.2	3,235	3,314.0	(198.6)	(79.4)	13,159	13,159	
1.5.7 Ring Systems Diagnostic Instrumentation	371.9	204.5	293.6	(167.4)	(89.0)	3,089.8	2,827	3,014.8	(262.5)	(187.6)	16,271	16,271	
1.5.8 Collimation and Shielding	52.9	42.8	35.4	(10.1)	7.4	825.0	774	835.7	(51.4)	(62.2)	2,779	2,779	
1.5.9 Extraction System	46.3	24.4	37.1	(21.9)	(12.7)	686.9	568	548.6	(119.2)	19.1	5,756	5,756	
1.5.10 RTBT (Ring to Target Beam Transport) System	111.8	81.7	44.9	(30.1)	36.8	1,104.3	1,158	987.3	53.8	170.8	8,222	8,222	
1.5.11 Cable	2.6	2.9	0.0	0.3	2.9	6.3	7	0.7	0.3	5.9	2,899	2,899	
1.5.12 Technical Support	308.8	308.8	425.5	0.0	(116.8)	7,353.7	7,354	7,240.5	0.0	113.1	20,454	20,454	
WBS SUBTOTAL	1,836.3	1,097.5	2,256.2	(738.8)	(1,158.8)	31,894.3	30,763.9	31,614.8	(1,130.4)	(850.9)	127,631	127,631	
UNDISTRIBUTED BUDGET													
SUBTOTAL	1,836.3		2,256.2			31,894.3		31,614.8			127,631		
MANAGEMENT RESERVE													
TOTAL	1,836.3		2,256.2			31,894.3		31,614.8			127,631		

RECONCILIATION TO CONTRACT BUDGET BASE

DOLLARS EXPRESSED IN:	SIGNATURE OF PARTICIPANT'S PROJECT DIRECTOR:	DATE:
THOUSANDS	Bill Weng	May 29, 2001